A Popular History of British Crustacea; comprising a familiar account of their classification and habits. By Adam White, Assistant, Zoological Department, British Museum. Sq. 12mo. London, Reeve, 1857.

Mr. Reeve probably admires a good contrast; at least this is the only motive to which one can attribute his publishing consecutively two such opposite books as this and the one to which we have just called attention. In Mr. White's 'Popular History of the Crustacea' we have the carefully and conscientiously executed work of one who is well acquainted with his subject; and although we meet here and there with tolerably lengthy quotations relating to the habits of the animals described, it would be a hard-hearted critic indeed who would object to this, when the portion of the work evidently due to the author's own labour so greatly preponderates.

By this, we do not mean to say that any great amount of originality is displayed in its pages, and Mr. White himself is as ready as any one to acknowledge that in treating popularly of a subject upon which so much has been done, there is but little chance of striking into any new path; for he has evidently aimed solely at furnishing the young naturalist with a sketch of the characters and habits of the numerous Crustacea inhabiting the waters of our Islands, and it is not too much to say that he has been eminently successful. His little book is an extremely interesting and valuable addition to our popular literature of Natural History, especially as no work with the same scope was previously in existence, and the plates with which it is illustrated are, it seems to us, superior to most of those which have hitherto appeared in Mr. Reeve's series.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

May 14, 1857.—General Sabine, R.A., Treas. and V.P., in the Chair.

"On the Organization of the Brachiopoda." By Albany Hancock, Esq.

In the present memoir the author states at length, and fully illustrates by figures, the conclusions to which he has been led by a long series of researches into the anatomy of the Brachiopoda; investigations which have been conducted with a special reference to the discrepant opinions maintained by Prof. Owen and the older writers on the one hand, and by Prof. Huxley and himself on the other. Some of the points in dispute have already been discussed in a paper read before the British Association at Cheltenham, and in the present memoir the author not merely reiterates the statements which he then made, but gives a detailed account of the whole organization of the Brachiopoda based upon his dissections of the following species:—*Wald-*

heimia australis, W. Cranium, Terebratulina caput-serpentis, Rhynchonella psittacea, Lingula anatina, and another species of *Lingula.*

The Brachiopoda are divisible into two groups, according as the valves of their shells are articulated or not. *Waldheimia* is the type of the former group, *Lingula* of the latter.

In the articulated forms there are usually three apertures opening into the pallial chamber; of these, one is the mouth,—the other two are situated at the apices of the organs which have been described as "hearts." In *Rhynchonella,* where there are four such "pseudo-hearts," there are of course five apertures instead of three. In *Lingula,* which possesses a distinct anus, opening on the right side of the pallial cavity, the apertures into the cavity are four, viz. one oral, one anal, and two appertaining to the pseudo-hearts.

After a description of the general arrangement of the organs in the articulated and non-articulated Brachiopoda, an elaborate account of the various systems of organs is given.

The muscles of the Terebratulidæ are divisible according to their functions into two groups,—the adductors of the valves, and those which adjust the shell upon the pedicle. Of the former, or "valvular" muscles, there are three pairs,—the adductors, cardinals, and accessory cardinals of previous writers; which the author prefers to term *occlusors, divaricators,* and *accessory divaricators.* Of the latter there are likewise three pairs, the so-called dorsal and ventral pedicle muscles and the capsular muscle; these the author terms the *dorsal and ventral adjustors,* and the *peduncular* muscle. The attachment of the muscles in *Waldheimia australis* and their actions are particularly described. The peduncular (capsular) muscle is shown to be the continuation of the muscular fibres contained within the peduncle. In the other articulated Brachiopoda examined, the arrangement of the muscles is essentially the same, but interesting differences are observable even in closely allied species.

Names in use.	Names proposed.	Names of homologous muscles of articulate Brachiopoda.
Anterior retractors ...	Anterior occlusors	Anterior occlusors.
Anterior adductors......	Posterior occlusors.........	Posterior occlusors.
Posterior adductors	Divaricators	Accessory divaricators.
Central protractors......	Central adjustors ...... }	Ventral adjustors.
External protractors ...	External adjustors ...... }	
Posterior retractors ...	Posterior adjustors.........	Dorsal adjustors.
Capsular	Peduncular	Peduncular.
	Anterior parietals.	
	Posterior parietals.	

Thus, in a species differing but little from *Waldheimia australis,* and in *W. Cranium,* the divaricators and accessory divaricators are united. In *Waldheimia Cranium* and *Terebratulina caput-serpentis* the dorsal adjustor muscles are not attached to a hinge-plate, but are inserted into the valve itself. In *Rhynchonella psittacea* there is a pair of peduncular muscles. In *Lingula* there are six pairs of muscles, all of which have both extremities attached to the valves. They have been divided into adductors and sliding muscles, the latter again being subdivided into protractors and retractors; but the author, considering that no sliding motion takes place, regards the latter terms as improper, and gives a set of new names, of which a concordance with the older denominations is given on the preceding page.

The author conceives that the valves are separated by the action of the divaricators, combined with that of the parietals; these muscles compressing the visceral cavity posteriorly, and thus driving its contents into the anterior portion. The antagonists of these are the occlusors; while the office of the adjustors appears rather to be to supply the place of a hinge, and to prevent anything like sliding of the valves one over the other.

The muscular fibres of *Lingula* are smooth and unstriated. In *Waldheimia* those of the posterior occlusors are strongly striated, but the rest of the muscles have smooth fibres. The arms, their attachment and minute structure are next fully described.

In *Waldheimia* the canals of the attached portions of the arms coalesce into a single wide tube, which lies externally between the produced and reflected crura of the calcareous loop, and is separated by a partition from a canal of corresponding size—the "brachial sinus,"—which also extends throughout the whole length of the produced and reflected crura, and is in fact a prolongation of the perivisceral chamber. The cirri are arranged in this and all the other Brachiopoda examined, in a double alternating series—not in a single row, as has hitherto been stated to be the case. The walls of the brachial canal are tolerably well supplied with delicate muscular fibres, which run diagonally round the tube, and are most strongly developed towards the sides, near the grooved ridge which supports the cirri. An indistinct band of exceedingly delicate longitudinal fibres may also be observed nearly opposite to it. The author has however completely failed to discover, either here or in *Rhynchonella*, anything like the double spiral arrangements of fibres described by Prof. Owen, and believes that the latter observer has mistaken the blood-sinuses for muscles.

The author doubts whether the spiral coil can be unwound, and conceives that the muscular fibres described, are chiefly for the purpose of giving firm support to the grooved ridge on which the cirri and brachial fold are seated, and thus affording the complex muscular fibres which the ridge contains a better fulcrum whence to act upon the cirri.

In *Terebratulina caput-serpentis*, which possesses no calcareous loop, the pallial lobe connecting the produced and reflected portions of the arms is strengthened by calcareous spicula, which are so numerous as to preserve the shape of the part even when the animal basis is removed.

In *Lingula* the arms contain two canals; one, the anterior, being the equivalent of the single canal in *Rhynchonella*, and, like it, terminating at the side of the œsophagus in a blind sac. The posterior brachial canal probably communicates with the perivisceral cavity and exhibits a peculiar arrangement of muscles, by whose action perhaps the arm can be exserted.

In addition to those parts of the alimentary canal and its appendages which are already known in the articulated Brachiopoda, the author describes a short median gastro-parietal band arising from the upper surface of the stomach and passing upwards and backwards to the dorsal parietes a little in advance of the hinge-plate. With regard to the existence or absence of an anal aperture in the articulated Brachiopoda, the writer states: "I have made numerous dissections under a powerful doublet, and have removed the part and examined it with a microscope: I have filled the tube with fluid as the fingers of a glove with air, and by pressure have attempted to force a passage: I have tried injections; but have equally, on all occasions, failed to discover an outlet, and have only succeeded in demonstrating more and more clearly the cæcal nature of the terminal extremity of the alimentary canal. Therefore, how much soever it may be opposed to analogy and to authority, the fact must be recorded—there is no anal orifice in *Waldheimia, Terebratulina*, or in *Rhynchonella*."

In *Lingula*, as in the articulated Brachiopoda, the first inflection of the intestine is towards the ventral surface, but the alimentary canal eventually ends in the easily observable anus placed nearer the dorsal than the ventral surface, on the right side of the body. The rudimentary mesentery, and the lateral gastro-parietal and ilio-parietal bands of *Lingula* are described. There is no median gastro-parietal band. Fæcal matter rolled into round pellets is commonly observable in the intestine of *Lingula*, while no fæces are ever found in that of the articulated Brachiopoda.

The genitalia in the articulate Brachiopoda are developed between the two membranes of which the inner wall of the pallial sinuses in which they are contained is composed, and, thrusting the inner of the two membranes from the outer, form a prominent mass connected by a band with the inferior wall of the sinus. The genital artery runs along the upper or outer edge of the band, and the genitalia are developed round it.

In *Lingula* the reproductive organs are withdrawn from the mantle and lodged within the visceral chamber, forming four irregularly lobulated or branched masses, two above and two below the alimentary canal, so that they may be distinguished as dorsal and ventral genital masses. The dorsal ovaries are suspended by the ilio-parietal bands, and the ventral by the continuation of these bands along the free margins of the pseudo-hearts. In both cases the attachment is along the margins of the bands, which are related to the genitalia much in the same manner as the suspending membrane is to the genital bands in *Waldheimia*; and it would seem that in *Lingula* the reproductive organs are really developed between the two layers composing the ilio-parietal bands. The author adduces arguments to show that the *Lingulæ* are hermaphrodite, the testis being a reddish mass, which ramifies over the true ovary.

The ova probably make their way out by the so-called "hearts," which open by their apices into the pallial cavity, and by their patulous bases (the so-called auricles) into the perivisceral chamber, and are hence capable of performing the functions of oviducts. The author has assured himself of the constant presence of the apical aperture of the pseudo-heart in all Brachiopoda. As pointed out by Prof. Huxley, there are four of these pseudo-hearts in *Rhynchonella*, but only two were found in the other Brachiopoda examined.

The pseudo-hearts have nothing to do with the propulsion of the blood, a function which is performed chiefly by the pyriform vesicle discovered by Prof. Huxley in *Waldheimia* and *Rhynchonella*, and which was found attached to the stomach in all the Brachiopoda examined. It is composed of two layers, the inner distinctly muscular, the outer transparent and homogeneous. Connected with this heart are vessels or blood-channels (particularly described in the Memoirs); the "venous canals," which open into it anteriorly, returning the blood conveyed by the posterior arterial channels into the system of peripheral sinuses originally described by Prof. Huxley.

Accessory "hearts" or pulsatile vesicles have been found in some of the articulated Brachiopoda; the mantle and the walls of the body are essentially composed of a plate of substance traversed by reticulated lacunæ, and lined upon each side with epithelium. After explaining at length the distribution of the lacunæ throughout the mantle, the sheath of the intestine, its bands, the genital folds, the arms, &c., the author proceeds to give the following sketch of the course of the circulation:—

"Having now gone over all that I have been able to ascertain with respect to the central and peripheral portions of the circulatory apparatus, and having also examined the lacunes and blood-canals of the brachial organs, it will not be difficult to follow the flow of the blood throughout its entire course in *Waldheimia*; and as it is in it, so will it be in all probability in all other Brachiopods.

"It has been shown that the heart is a simple, unilocular, pyriform vesicle, suspended from the dorsal aspect of the stomach, and projecting freely into the perivisceral chamber; that there is neither auricle nor pericardium,—unless the membrane which closely invests it can be so called,—that it is hardly more complex in structure than the pulsating vessel of the Tunicata; and that in *Lingula*, indeed, it scarcely at all differs from the heart of these lowly organized mollusks. This vesicle, or heart, propels the blood through four arterial trunks or channels, to the reproductive organs and mantle, and probably also to the alimentary tube, and is apparently assisted by four or more pulsating vesicles in connexion with these principal trunks. The blood thus conveyed by the genital or pallial arteries will escape by the lacunes in the membranes suspending the genitalia, into the plexus in the floor of the great pallial sinuses. Thence it will find its way into the outer lacunary system of the pallial lobes, and into that of the dorsal and ventral walls of the body, as well as into the lacunes of the anterior parietes. Having saturated all these parts of the peripheral system, it will divide itself into two currents, one of which will set backwards in the direction of the membranous bands connecting the alimentary tube to the parietes, and will flow through their channels into the system of visceral lacunes, which encircle the alimentary canal within the sheath, and which probably carry blood to the liver. This current will also supply blood to the lacunes nourishing the muscles. The blood thus directed will reach the branchio-systemic vein, either by the great œsophageal lacunes, or through the foramina which penetrate the sides of the channel as it runs along the dorsal ridge of the stomach.

"The other blood-current will set forward in the direction of the base of the arms, and some of it will pass into these organs through their general system of lacunes; but the principal portion will be carried by the afferent brachial canal to the extensive plexus of lacunes in those parts, and will circulate, in the manner before pointed out, within the walls of the great brachial canal. The blood will then be drawn up one side of the cirri through the vessels—the afferent brachial arteries—originating in the great brachial plexus, and returning down the other, will be poured into the efferent brachial canal, and thus reach the lateral efferent sinuses at the root of the œsophagus. Thence it will enter the great œsophageal lacunes, and there meeting with the other current of returning blood from the visceral lacunes, will be carried to the heart by the branchio-systemic vein along the dorsal side of the stomach.

"Thus it is perceived that the blood finds its way back to the central organ in a mixed condition. That which is conveyed by the gastro-parietal and other bands will be imperfectly aërated, having only flowed through the pallial membranes, which must be looked upon as but accessory oxygenating agents. The arms undoubtedly perform the office of gills, and are true respiratory organs. The blood which circulates through them will consequently be returned in a perfectly aërated condition, to be mixed, however, with that in a less pure state from the visceral lacunes before it enters the heart. This mixed state of the blood is not by any means peculiar to these animals, for it obtains in many of even the higher mollusks."

The perivisceral cavity and the great pallial sinuses have no communication with the proper blood-vascular system, but are to be compared to the atrium of the Ascidianida, and the water-chambers of the Cephalopoda and other mollusca. The pseudo-hearts enable the perivisceral cavity to communicate with the exterior, and convey away the genital, and probably the renal products. On this head the author says:—

"From the foregoing account of the circulatory apparatus, it would appear that the perivisceral chamber, and its various so-called vascular ramifications in the mantle, are not connected with the blood-system. This is no doubt a startling fact. I commenced the present investigation fully imbued with the opinion that these parts were blood reservoirs and channels, and I only relinquished it when it became no longer tenable. Step by step the points relied on had to be abandoned, until at length the full conviction was arrived at that I had been seeking to establish a fallacy. I have been unable to discover any communication between the true blood-system and the pseudo-vascular ramifications in the mantle or the perivisceral chamber. Injections were thrown into this chamber, but none of the fluid found its way into any part of the lacunary system. The pallial lobes were removed, and the great pallial sinuses distended to their fullest capacity, with exactly the same result; and it was not until the tissues were ruptured on applying great pressure, that a little of the injected matter was extravasated into the peripheral lacunes. The perivisceral chamber, then, and all its various ramifications, are in no way connected with the true blood-system."

The nervous system of the articulated Brachiopoda is described at length. Besides the principal subœsophageal ganglion, two minute enlargements are shown to exist upon the anterior part of the œsophageal commissure, and two small pyriform ganglia are described in connexion with the under part of the principal ganglion. The peripheral nerves are minutely traced out, and two peduncular nerves, not hitherto known to exist, are described. The author denies the existence of the so-called "circumpallial" nerves. He has been unable to detect the nervous centres in *Lingula*, and he is inclined to regard the cords, described as nerves in that genus by Prof. Owen, as blood-sinuses.

The author next makes some remarks on the structure of the shell, pointing out that in *Terebratulina caput-serpentis* there are two distinct layers, an external and an internal; and he then draws attention to the important anatomical characters which separate the articulated Brachiopoda as a group from the inarticulate division.

In conclusion, the author draws a parallel between the Brachiopoda and the Polyzoa, demonstrating the close structural conformity between these two groups.

"On the Placenta of the Elephant." By Professor Richard Owen, F.R.S., &c.

In this paper the author gives a description of the fœtal membranes and placenta of the Indian Elephant. The chorion forms a transversely oblong sac about 2 feet 6 inches in long diameter, encompassed at its middle part by a placenta of an annular form, 2 feet 6 inches in circumference, from 3 inches to 5 inches in breadth, and from 1 inch to 2 inches in thickness; in structure resembling that of the annular or zonular placenta of the Hyrax and Cat. The part of this placenta which had been detached from the maternal portion occupied a narrow annular tract near the middle line of the outer surface. A thin brown deciduous layer was continued from the borders of the placenta for a distance varying from 1 to 3 inches upon the outer surface of the chorion. Flattened folds of a similar layer of substance, or false membrane, could be raised from some parts of the surface of the placenta; at other parts the substance formed irregular fibrous bands,—the fibres extending in the direction of the circumference of the placental ring. The outer surface of the chorion is for the most part smooth and even shining, but at each of the obtuse extremities of the sac there was a villous subcircular patch, between 2 and 3 inches in diameter, the villi being short and graniform, $\frac{1}{6}$th of a line in diameter or less. Thus the chief points of attachment of the chorion to the uterus are, at the equator by the annular placenta, and at each pole of the elongated sac by the subcircular villous patch. The umbilical cord was short and rather flattened: it was formed by two arterial and one venous trunks, and by the slender neck of the allantois, with the connecting cellular tissue and the covering of amnios: it measured about 6 inches in length, before the division of the vascular trunks, and about 3 inches in circumference. The inner surface of the amnios is roughened by brownish hemispherical granules, from 1 line to $\frac{1}{10}$th of a line in size—commonly about $\frac{1}{2}$ a line; the outer surface is finely wrinkled, but smooth; the amnios is continued from the base of the umbilical cord upon the allantois, which is of considerable size, and is so interposed between the chorion and amnios as to prevent any part of the amnios attaining the inner surface of the placenta. The amnios consists of two layers: one is the granular layer, continued upon the inner or fœtal surface of the allantois, and thence upon the umbilical cord; the other is the smooth outer layer, continued upon the outer or chorional surface of the allantois, and thence upon the inner surface of the chorion. The allantois divides where the amnios begins to be reflected upon it into three sacculi; the disposition of these sacculi is described in detail. The chief peculiarity was the presence, upon the inner layer of the allantois, and chiefly upon the endochorionic vessels, of numerous flattened oval or subcircular bodies, varying in diameter from an inch to half a line: their tissue was compact, structureless, and of a grey colour. On dissecting some of the vessels over which these bodies were placed, the vessel was found to pass on the chorionic side of the body without undergoing any apparent change, the body being developed from the allantois, and from that part which forms the allantoic side of the sheath of the vessel. These bodies were most numerous near the placenta: their free surface was smooth, not villous like the cotyledons of the Ruminantia, from which they likewise differed in projecting inwards towards the cavity of the allantois. The most important modification of the vascular structures connecting the chorion with the uterus, in the Elephant, is their combination of two forms of the placenta, viz. the 'annular' and the 'diffused,' which have hitherto been supposed to characterize respectively distinct groups of the class Mammalia.

The author concludes by a comparison of the different known forms of the placenta, including those of the *Pteropus* or large frugivorous Bat, and of the Chimpanzee; and by remarks on the value of placentary characters in the classification of the Mammalia.

June 15, 1857.—The Lord Wrottesley, President, in the Chair.

"On the Causes and Phænomena of the Repulsion of Water from the Feathers of Water-fowl and the Leaves of Plants." By George Buist, D.C.L. of Bombay, F.R.S.

Happening to reside in Bombay, in the neighbourhood of a number of small tanks or ponds abounding with the Lotus or sacred bean of India, and with four different varieties of Water Lily, I was struck with the different appearances presented by these when immersed in water, or when water was sprinkled on them. The leaves of the lily, like those of the Lotus, floated with considerable buoyancy on the surface, but never, like the Lotus, rose above it, on a tall independent stem. The lily leaf is full of holes about the size of a pin's head, and serrated at the edges. Through these, when the leaf is pressed down, the water perforates freely. The upper surface of the leaf is smooth and shining, and water runs off it without wetting it, as it does off a piece of glass or greased surface. When placed under the water at an angle of about 45°, the leaf of the lily seems to change colour; the dark purple leaf of the red lily appears of a bright rich pink, the dark green or bluish-green of the white, pink, and blue lilies seem to become of a bright emerald-green; the intensity of these hues varying with the angle at which the immersed leaf is seen.

When the Lotus leaf is placed under water it reflects light like a mirror, so that the image of any object, if presented to it at a proper angle, is seen by the spectator as distinctly as if the surface were one of polished metal. When water is thrown on the surface of a floating leaf, it flows off like a pool of quicksilver, reflecting light from the whole of its lower surface; and this holds good on all occasions. The repellent property of the leaf is on the upper side only, for the lower side is always wet, being only destroyed by severe rubbing. These peculiarities seem long to have been familiar to the natives, and have given rise to the Mahratta lines in reference to the virtuous man, which may be thus translated :—

> "He is not enslaved by any lust whatever;
> By the stain of passion he is not soiled,—
> As in the water, yet unwet by the water,
> Is the Lotus leaf."

On examining carefully into the cause of this, I found the Lotus leaf covered with short microscopic papillæ, which entangle the air and establish an air-plate over the whole surface, with which in reality the water never comes in contact at all. Another peculiarity connected, but not necessarily so, so far as I could discover, with this, was the singular respiratory pores of the Lotus. The leaves of the Lotus, when full-sized, are from a foot to 16 inches in diameter; on cutting off a leaf 6 inches broad, the stalk of which was less than the third of an inch in diameter, I was able to collect 33 cubic inches of air in an hour, when the vital energies of the plant must have been injured by its mutilation; at this rate a tank covered with Lotus leaves would produce daily an atmosphere 4 feet in depth throughout its whole surface. When the leaf is pushed slightly under water, a constant succession of air-bubbles seem to arise from it, at the rate of two or three a minute at each spiracle. The air-bubble diffuses itself as it is extricated, presenting a very broad base to the leaf and blunt low-crowned apex, and seems detached with difficulty. The air-plate all over the surface must thus become continually renewed and the arrangement kept perfect.

Sensible respiration is not at all essential to the repelling power of leaves; the most beautiful manifestation of it I have met with is in the *Pestia*, a little floating water-plant abounding in our shallow tanks, and resembling common endive. When pushed under the surface, it looks like a little mass of burning silver. The same appearance is presented on cabbages, young clover, and a vast variety of other leaves; it is the cause of the bright pearl-lustre of dew. The same phenomenon is manifested on the wings and backs of divers when they dash into the water. In this case it has been ascribed, most erroneously as I believe, to the presence of grease or oil in the feathers, and is, I have no doubt, due to the presence of an air-plate repelling the water, so that it never comes in contact with the feathers at all. The trimming process, so carefully performed by Water Fowl, is probably an application of oil or grease, with the object of separating or dressing the little fibres of the feathers so as to produce an arrangement fitted to entangle the air. The reflexion of light from the lower surface of the water is the proof of want of contact. A piece of polished marble or of glass, a waxed, oiled or greased surface, readily throws off the water without remaining wetted; but no reflexion is in this case observable.

Might not the manufacturers of waterproof cloth or clothes take a hint on this point from the economy of nature? Could they manage to produce a surface such as would entangle and retain a film of air, no india-rubber varnish or other water-tight material would be required, while the texture would permit the free transmission of respiration or moisture from the body, which Mackintosh's and other similar contrivances obstruct.

BOTANICAL SOCIETY OF EDINBURGH.

May 14, 1857.—Professor Balfour, Vice-President, in the Chair.

The following papers were read:—

1. "Notice of two cases of Poisoning with the seeds of *Thevetia nereifolia*," communicated, with remarks, by Dr. Douglas Maclagan.

The history of these cases, which occurred in India, was furnished by Dr. John Balfour, H.E.I.C.S. The symptoms were narcotico-irritant, the irritant character predominating, and the somnolence and other cerebral phænomena being, in Dr. Maclagan's opinion, probably as much those of exhaustion as of true narcotism. There was vomiting of a peculiar character. *Thevetia nereifolia*, Juss. (*Cerbera Thevetia*, L.), now naturalized in India, appears to have been introduced probably from South America.

2. "Account of the Insect which infests the seeds of *Picea nobilis*," by Andrew Murray, Esq., F.R.S.E.

The *Picea nobilis* was first introduced into this country from the north-west of America by Douglas in 1831. No second importation